



**MEMORANDUM**

**To:** EEI

**From:** Scott J. Bloomberg and Anne Smith - CRA

**Date:** August 13, 2004

**Subject:** **MODELING OF EEI'S ALTERNATIVE HG CAP AND TRADE OPTION**

This memo summarizes the results of an EPMM model run simulating the impacts of the EEI's proposed alternative Hg Cap and Trade program ("Alt Hg Option"). Under this option, there would be no hard Hg cap until 2015. However, early reduction credits could be earned and banked during the period 2010-2014 if Hg emissions were to be consciously reduced through early application of control technology. Phase I of the Hg cap starts in 2015 and is set to 24 tons. Phase II starts in 2018 when the cap is lowered to 15 tons in 2018.<sup>1</sup>

The standard summary tables for this case are attached as an Excel file. This memo highlights the key results, primarily through comparison with results from EPA's proposed Hg Cap and Trade Rule ("Hg Rule"), which has a cap of 34 tons starting in 2010, reduced to 15 tons in 2018. Both scenarios were run with identical assumptions except for the timing and level of the Hg caps.

The Alt Hg Option and the Hg Rule results presented here both were simulated with an assumption that there would be gradual improvement in activated carbon injection (ACI) Hg control technology: a 2.5 percent annual reduction in the current estimate of the variable costs only of ACI-based technology.<sup>2</sup> The summary tables for this specific version of the Hg Rule scenario are also attached to this memo.

***Hg Emissions***

Table 1 shows projected emissions under the Alt Hg Option and under the Hg Rule. In the Hg Rule scenario, the model indicated a significant cost to reduce as far as the 34 ton cap from the co-benefits level of 39.9 tons in 2010 (i.e., over \$20,000/lb marginal cost). It is not surprising

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<sup>1</sup> To simulate early reduction credits, the model run set caps equal to co-benefits during this period. Reductions below this level would be incurred only if doing so were to be financially advantageous when the early reduction credits could be used in 2015 and later. The co-benefits levels were defined as the Hg emissions from the comparable model run for an "CAIR Only" scenario that was previously distributed by CRA/EEI. They are 39.9 tons for 2010 and 2011, and 38.5 tons for 2012 through 2014.

<sup>2</sup> This type of improvement is consistent with improvement in the cost-effectiveness of sorbents, either through reduced costs per pound of sorbent relative to today's prices for activated carbon, through engineering advances that would require less sorbent to be injected per percent of reduction achieved, and/or through changes in baghouse filter material that would reduce their costs, or their frequency of replacement compared to today's estimates.

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therefore that the voluntary-only early reductions under the Alt Hg Option (i.e., those that occur before 2015) are at first smaller than under the Hg Rule. Emissions in 2010 are 36.6 tons under the Hg Alt Option, compared to the 34 tons that are required in that year under the Hg Cap case. However, emissions under the Alt Hg Option, which has no hard cap at all until 2015, fall *below* those estimated under the Hg Cap even by 2012. This faster reduction in Hg emissions on a purely voluntary basis is due to the effect of the much tighter cap that the Alt Hg Option imposes by 2015 than would exist under the Hg Rule, combined with the ability to earn early reduction credits before 2015. Alt Hg Option Hg emissions remain lower than under the Hg Rule Option until 2020, when emissions stabilize at the ultimate capped level of 15 tons in both scenarios.

<b>Table 1. Hg Emissions (short tons)</b>		
<b>Year</b>	<b>Alt Hg Option</b>	<b>Hg Rule</b>
2004	44.4	44.4
2008	43.2	43.2
2010	36.6	34.0
2012	32.1	32.6
2015	27.5	29.4
2018	22.6	24.1
2020	15.0	15.0

***Hg Permit Prices***

Marginal costs of control of Hg are shown in Table 2. They are fairly similar in both cases, and identical in 2020 when emissions reach the identical level of 15 tons in both cases. However, the ability to voluntarily decide on the rate of phase-in to achieve an ultimate cap of 15 tons leads to a steadier trend in the Hg permit prices under the Alt Hg Option, while also achieving greater reductions in each year from 2012 to 2020. The Hg permit prices climb from \$18,000 in 2010 to \$32,000 in 2020, in all years keeping below the safety valve permit price.

<b>Table 2. Hg Permit Prices (1999\$/lb)</b>		
<b>Year</b>	<b>Alt Hg Option</b>	<b>Hg Rule</b>
2004	NA	NA
2008	NA	NA
2010	\$17,758	\$20,854
2012	\$19,957	\$18,727
2015	\$23,802	\$22,335
2018	\$28,408	\$26,657
2020	\$32,536	\$32,536

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### *Hg-Related Retrofits*

Table 3 shows the projected timing of retrofits that affect Hg emissions levels. The total capacity that receives ACI-based controls is nearly identical between the two cases. In total, 112 GW of ACI-type controls are installed through 2020 in both cases. The cumulative quantity of Hg-specific controls installed in each model year climbs as the cap tightens, but the rate of increase is more gradual under the Alt Hg Option. This trend allows more opportunities to learn-by-doing, and to take advantage of technological improvements in the Alt Hg Option.

Total installations of FGDs are also nearly identical between the two cases. In the Alt Hg Option case, however, certain installations of FGDs that occurred in 2010 in the Hg Rule case are deferred to 2012, indicating that the precise timing of these FGDs is affected by their value for Hg co-benefits. This also makes control effort more cost-effective without undermining environmental goals.

<b>Table 3. FGD and ACI Retrofits (MW)</b>				
	<b>Alt Hg Option</b>		<b>Hg Rule</b>	
<b>Year</b>	<b>FGDs</b>	<b>ACI+FF or ACI+COHPAC</b>	<b>FGDs</b>	<b>ACI+FF or ACI+COHPAC</b>
2004	3,522	1,050	3,522	1,050
2008	5,943	1	5,952	1
2010	28,240	6,347	35,187	15,371
2012	18,230	12,368	10,542	1,352
2015	3,384	25,456	2,980	15,399
2018	16,910	23,162	14,792	26,397
2020	33,861	43,532	37,068	52,476

### *Other*

There are no significant differences between the two cases with respect to the amount of generation from coal plants, nor is there any significant difference in the types of coals consumed. The incremental resource cost of the two cases is nearly identical, with the Alt Hg Option case slightly less expensive, despite having larger Hg reductions from 2012 until 2020. The Hg Rule has an estimated present value cost of \$19.4 billion and the Alt Hg Option has a present value cost of \$19.1 billion (present value of costs from 2004-2020 in 1999 dollars).